C2

23. (newly added) The method of claim 11, wherein the reaction between the metal layer and the oxidant comprises oxidizing the metal layer with the oxidant to form an oxide layer on a surface of the metal layer.

REMARKS

Present Status of the Application

Claims 1-17, 21 and 22 remain pending of which claims 1-17, 21 and 22 stand rejected under 35 U.S.C. § 103(a) as purportedly being unpatentable over Farkas et al. (US 6,001,730, Farkas hereinafter) and Penniman (US 5,373,229, Penniman hereinafter). Claims 1, 3-5, and 11 have been amended and claim 2 has been canceled to more explicitly and more clearly describe the claimed invention. It is believed that no new matter is added by way of these amendments made to the claims or specification or otherwise to the application.

The Applicants have most respectfully considered the remarks set forth in this Office Action. Regarding the obviousness rejections, it is however strongly believed that the cited references are deficient to adequately teach the claimed features as recited in the amended claims. The reasons that motivate the above position of the Applicants are discussed in detail hereafter, upon which reconsideration of the claims is most earnestly solicited.

Response to 35 U.S.C. 103 (a) rejecti n

Claims 1-17 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable Farkas et al. (U.S. 6,001,730, Farkas hereinafter) and Penniman (U.S. 5,373,229).

Applicant respectfully asserts that *Farkas and Penniman are* legally deficient for the purpose of rendering claims 1 and 11 unpatentable for at least the reason that references do not posses any reason, suggestion or motivation form the prior art as a whole for the person of ordinary skill to modify or combine the references.

The technical impact of the present invention is that by introducing **an oxidant for the metal layer** into the second slurry during the removal of the barrier layer, the oxidant reacts with the metal layer by oxidizing the metal layer. The zeta potential of the metal layer thus changes, and carbon-rich particles, produced during the CMP process if low K-dielectric material is exposed, are prevented from adhering onto the surface of the metal layer. Defects formed on the surface of the metal layer are thus mitigated. Since the low K-dielectric material is likely to be exposed during the removal of the barrier layer, **it is thus essential for the instant case that during the removal of the barrier layer**, the second slurry that is used to remove the barrier layer includes an oxidant for the metal layer to react with the metal layer. Further, the reaction between the oxidant and the metal layer alters the zeta potential of surface of the metal layer in such a way that the value of the zeta potential of the surface of the metal layer is approximate to the zeta potential value of the carbon-rich particles. As a result, the carbon-rich particles, generated from the low K dielectric layer underneath the barrier layer, are prevented from adhering onto the surface of the metal layer while the barrier layer is being removed.

Farkas, on the contrary, teaches a two-step or a possible three-step CMP process for forming a copper interconnect that uses a tantalum-based barrier layer. The copper interconnect polish steps of Farkas uses particular slurries in conjunction with specific types of polishing pad to reduce the problem of dishing. The first CMP process of Farkas for removing the metal layer is conducted with a slurry that contains an oxidizing agent (col. 5, lines 43-60). A second CMP process of Farkas for removing the barrier layer is conducted with a slurry that contains silica abrasive and an ethylendiamine additive. The Office contends that the solution of Farkas also adjust zeta potential. Applicants, however, respectfully submit that the alleged adjustment of the zeta potential of Farakas is not resulted from an oxidation reaction between the metal layer and the oxidant. It is due to such a reaction between the oxidant and the metal layer that the zeta potential of the surface of the metal layer is altered to have a value approximate to that of the carbon-rich particles. The simple presence of charged ionic species, such as, ethylenediamine and other solids in Farakas second slurry, does not alter the zeta potential of the metal layer as required by the present invention. Although the Office further asserts that the amine or alcohol in the second slurry of Farakas are oxidants, no component in the second slurry of Farakas is an oxidant for the metal layer, such as, a copper, tungsten or aluminum layer as taught in claim 7. Therefore, the zeta potential of the metal layer would not be altered in a way as taught by the present invention.

In view of the foregoing, Applicants respectfully assert that the prior art cited by Examiner is legally deficient for the purpose of rendering claims 1 and 11 unpatentable. With regard to dependent claims 2-10, 12-18 and 21-22, Applicants respectfully submit that these

claims patently define over the prior art for at least the same reasons as independent claims 1 and 11. Withdrawal of the rejection and allowance of the application are earnestly requested.

Newly Added Claim

Applicants have added dependent claim 23 so as to limit further the claimed subject matter of claim 11 of the present invention. Therefore, it is believed claim 11 is patentable for the above reasons.

CONCLUSION

For at least the foregoing reasons, it is believed that all pending claims 1-17, 21-23 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

WU & CHEUNG, LLP

Dated: July 7, 2003

By: _____
Charles C.H. Wu, Esq.
REG. NO. 39,081
7700 IRVINE CENTER DRIVE, STE. 710
IRVINE, CALIF. 92618-3043
TEL: 949-251-0111
FAX: 949-251-1588
E-MAIL: CCHWU @ EARTHLINK.NET
USPTO CUSTOMER NO.: 25864